State of Montana
Bresnan Communications
Joint Meeting

Thursday September 3, 2009

Agenda

- *Network*
  - Recent outages
    - Juniper reboots
  - Network Enhancements
    - University Failover
  - Cable Modem/DSL
- *Next Steps*

Network Operations

Jeff Thornton – V.P. Network Operations

Outages

- Butte – Dillon
- Core Outage – 8/13/09
- Regional Outage 8/25/09

- Durations
  - 4 - ≤ 7:00 min
  - 5 - ≤ 60:00 min
  - 4 - > 60:00 Min

Juniper Re-boots

- Bresnan has been working with Juniper on hardware bug over the past 60+ days
- Fix has been deployed in Hardin for two weeks and has stabilized router
- Upgrade schedule in development for affected routers
- Plan is to soak affected routers for 60 days prior to full upgrade of all units

Dillon – Butte Sites - Service Disruption Sampling

- **4/8/2009 – INC2266140 - Power Distribution to Router Failed – 1 Hour**
  - Router power feeds moved to different source to restore and then configured for redundant A/B feeds.
- **6/17/2009 – INC2458785 - Physical Interface Card (PIC) Failure on Missoula Router – 3.5 Hrs**
  - Services moved to different interface on same card to restore
- **6/20/2009 – INC2458785 - Same PIC Failure on Missoula Router – 1 Hour**
  - Reboot Router to Restore
- **6/21/2009 – INC2458785 – Same PIC Card Replacement – 5 Min**
  - Physical Interface Card Replaced – Service Moved to Original PIC
- **7/8/2009 – 2517948 – Same PIC Card Interface Failed on Missoula Router – 45 Min**
  - PIC card moved to different slot in router chassis.
- **7/9/2009 - 2517942 – Replaced Chassis on Router w/ Chronic PIC Card Failures – 16 Min**
- **7/14/2009 – 2531924 – Routing Engine Failover on Helena Router – 2 Min**
  - Proper fail over, 2 minute re-converge – Cause was CFEB Card which has been replaced
- **7/24/2009 – 2561662 – T1 to U of M Dillon bounced – 5 Min**
  - This restored while investigating.
- **7/29/2009 – 2573540 – Planned Maintenance - Inadvertent Impact – 38 Min**
  - Switch ports mis-configured during maintenance window, then corrected

Event Summary – Regional Outage 8/13

- Event
  - IP Outage – All Markets
- Trouble Ticket Number
  - #2619627
- Date/Time Started
  - 8/13/09
  - 6:35 PM MST
- Location
  - All Markets
- Status
  - Restored
- Date/Time Cleared
  - 08/14/2009,10:30am: Billings and Wyoming Markets
  - 08/14/2009, 4:30 pm: Colorado Markets
- Total Duration
  - 21 hours 55 minutes

Root Cause Analysis - Regional Outage 8/13

- Cause
  - A Bresnan engineer incorrectly made changes to a BGP routing configuration on our Grand Junction, CO Core router. This error allowed the BGP to flood OSPF routing tables which overloaded the switch. This spilled over to the neighboring routers in Wyoming and Montana causing a shut-down of routed traffic to these regions
- Action/Resolution
  - Resolution of the outage involved several steps, as the routers once revived and cleared of the invalid routing information, would again quickly learn the invalid routes from their still affected neighbors
  - Once the trouble was correctly diagnosed, the solution was to disable inter-market circuits, effectively isolating portions of the network, then restore the routers to service and reconnect them to the healthy portions of the network. This process was repeated until all customer services were restored by mid afternoon on the 14th

Event Summary – Core Outage 8/25

- Event
  - Missoula to Helena Transport Failure
- Trouble Ticket Number
  - #2652017
- Date/Time Started
  - 8/25/09
  - 4:37 AM MST
- Location
  - Helena, MT
- Status
  - Restored
- Date/Time Cleared
  - 08/15/2009, 9:31am: 5 SoMT sites
  - 08/15/2009, 10:07am: 2 SoMT sites
- Total Duration
  - 5 hours 30 minutes

Root Cause Analysis – Core Outage 8/25

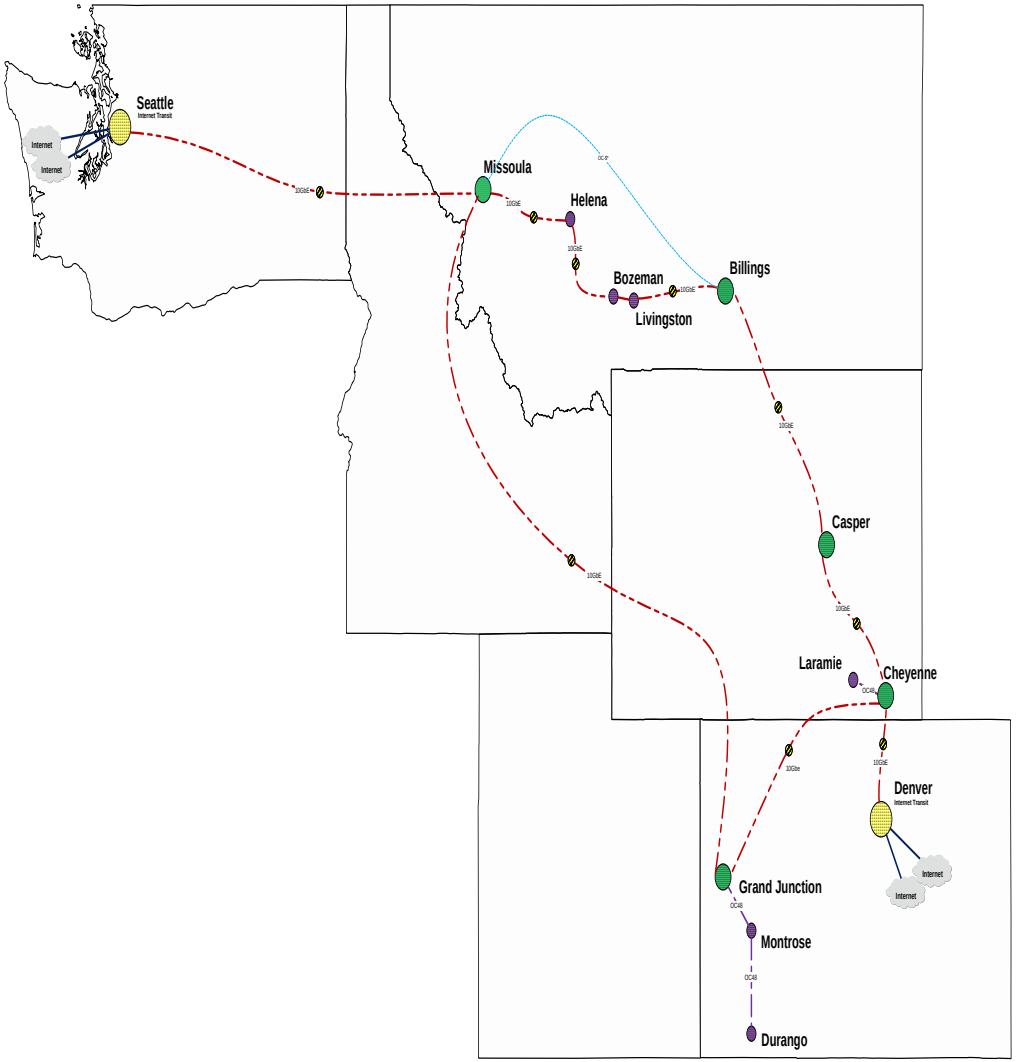
- Cause
  - A 32DMX card in the Northern ROADM system failed which caused one 10G and one 2.5G link to go down between Missoula and Helena.
- Action/Resolution
  - 7 impacted SoMT locations were manually configured to re-route on the available network capacity provided by 360 Networks
  - Determined that initial failover configurations were not implemented as per specifications and Bresnan team is reviewing and validating all SoMT circuit configurations

Network Engineering

Pragash Pillai, V.P. Network Engineering

Bresnan New Core & IP Transit

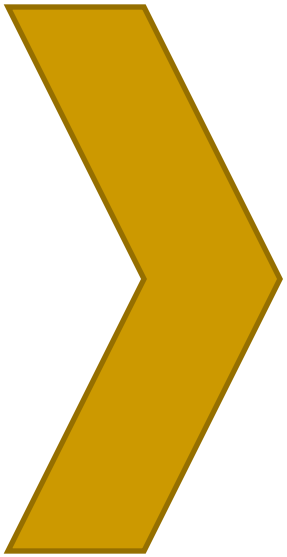
- This is still a logical view of how the routers would see the network
- Benefits
  - Core can have a capacity upgrade independent of Transit links
  - No traffic other then transit terminates in a Fiber Hotel
  - It gives us full redundancy in every core market would have 2, 10 gig core routers
  - It would cost less then ½ for the routers that are currently being proposed
  - Reduce core devices
    - **Less chance for failure or mis-configuration**
    - **Higher availability and improved reliability**



Hardware Improvements

Juniper M10i (existing)

- 1 G Interfaces
- 7.6 G Throughput
- 4 Queues
- 1 million routes
- Single switch fabric



Juniper MX480 (new)

- 10 G Interfaces
- 360 G Throughput
- 8 Queues
- 2 million routes
- Multiple switch fabrics

Bresnan 2009 Core Upgrade Project Timeline

Task Name	Duration	Start	Finish
2009 Core Upgrade Project	**65 days?**	**Thu 8/20/09**	**Thu 11/19/09**
Network Testing	**20 days**	**Fri 9/11/09**	**Fri 10/9/09**
Phase I P (Core) Testing	0 days	Fri 9/11/09	Fri 9/11/09
Phase II PE (Distribution) Testing	0 days	Fri 10/9/09	Fri 10/9/09
Missoula	**9 days?**	**Thu 9/3/09**	**Wed 9/16/09**
Power Up	1 day?	Thu 9/3/09	Thu 9/3/09
Production Ready	1 day?	Fri 9/11/09	Fri 9/11/09
Cut Over	1 day?	Wed 9/16/09	Wed 9/16/09
Billings	**28 days?**	**Thu 8/20/09**	**Tue 9/29/09**
Power Up - Granite Tower	1 day?	Thu 8/20/09	Thu 8/20/09
Production Ready	1 day?	Fri 9/25/09	Fri 9/25/09
Cut Over	1 day?	Tue 9/29/09	Tue 9/29/09
Cheyenne	**23 days?**	**Fri 9/11/09**	**Tue 10/13/09**
Power Up	1 day?	Fri 9/11/09	Fri 9/11/09
Production Ready	1 day?	Fri 10/9/09	Fri 10/9/09
Cut Over	1 day?	Tue 10/13/09	Tue 10/13/09
Casper	**23 days?**	**Fri 9/25/09**	**Tue 10/27/09**
Power Up	1 day?	Fri 9/25/09	Fri 9/25/09
Production Ready	1 day?	Fri 10/23/09	Fri 10/23/09
Cut Over	1 day?	Tue 10/27/09	Tue 10/27/09
Grand Junction	**40 days?**	**Fri 9/25/09**	**Thu 11/19/09**
Power Up	1 day?	Fri 9/25/09	Fri 9/25/09
Production Ready	1 day?	Fri 11/13/09	Fri 11/13/09
Cut Over	1 day?	Thu 11/19/09	Thu 11/19/09
SoMT - On Core	0 days	Tue 9/29/09	Tue 9/29/09